

## Claims

- [c1] A radio frequency space cooling system for a magnetic resonance imager system comprising:
  - a thermal energy transfer device reducing temperature of a cooling fluid within the radio frequency space cooling system; and
  - at least one cooling element coupled to said thermal energy transfer device and extending along a patient bore between a radio frequency shield and a radio frequency coil of the magnetic resonance imager system, said at least one cooling element having at least one channel for passage of said cooling fluid.
- [c2] A system as in claim 1 wherein said thermal energy transfer device is at least one of a cryocooler and a heat exchanger.
- [c3] A system as in claim 1 wherein said at least one cooling element comprises a plurality of cooling elements that are coupled in series.
- [c4] A system as in claim 1 wherein said at least one cooling element comprises a plurality of cooling elements that are coupled in a serpentine manner.

- [c5] A system as in claim 1 wherein said at least one cooling element is formed at least partially of a conductive material.
- [c6] A system as in claim 1 wherein said at least one cooling element is formed at least partially of a conductive material selected from at least one of copper and stainless steel.
- [c7] A system as in claim 1 wherein said at least one cooling element comprises:
  - a plurality of extension members; and
  - a plurality of coupling members.
- [c8] A system as in claim 7 wherein at least one of said plurality of coupling members are non-conductive.
- [c9] A system as in claim 7 wherein at least one of said plurality of coupling members are U-shaped.
- [c10] A system as in claim 1 wherein said at least one cooling element comprises:
  - an input; and
  - an output non-conductively coupled to said input.
- [c11] A system as in claim 1 wherein said at least one cooling element extends across a significant length and along a z-axis of said patient bore.

- [c12] A system as in claim 1 wherein said at least one cooling element extends parallel to at least one rung of said radio frequency coil.
- [c13] A system as in claim 1 wherein said at least one cooling element extends over end-rings of said radio frequency coil.
- [c14] A system as in claim 1 wherein said at least one cooling element comprises a single continuous channel.
- [c15] A system as in claim 1 wherein said at least one cooling element is radially offset from at least one rung of said radio frequency coil.
- [c16] A magnetic resonance imager system comprising:
  - a gradient coil assembly;
  - a radio frequency shield;
  - a radio frequency (RF) coil; and
  - at least a portion of an active cooling system residing between said radio frequency shield and said radio frequency coil, said active cooling system preventing thermal energy transfer between said gradient coil assembly and said radio frequency coil.
- [c17] A system as in claim 16 wherein said active cooling system comprises at least one cooling element coupled be-

tween said radio frequency shield and said radio frequency coil and extending along a patient bore of the magnetic resonance imager system.

- [c18] A system as in claim 17 wherein said at least one cooling element comprise at least one channel for passage of a cooling fluid.
- [c19] A system as in claim 17 wherein said at least one element is coupled on said radio frequency coil.
- [c20] A system as in claim 17 further comprising at least one insulation layer coupled between said radio frequency coil and said at least one element.
- [c21] A system as in claim 17 wherein said radio frequency shield is coupled into said gradient coil assembly.
- [c22] A magnetic resonance imager system comprising:
  - a gradient coil assembly;
  - a radio frequency shield;
  - a radio frequency (RF) coil; and
  - at least cooling element residing between said radio frequency shield and said radio frequency coil, said at least one cooling element having at least one channel for passage of a cooling fluid.
- [c23] A system as in claim 22 wherein said at least one cooling

element comprises a plurality of cooling elements coupled in a serpentine manner, said plurality of cooling elements extend parallel to and along a z-axis of a patient bore of the magnetic resonance imager system.